

HISTORY OF THE DEVELOPMENT OF ROCKET TECHNOLOGY  
AND ASTRONAUTICS IN POLAND BEFORE 1949

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# HISTORY OF THE DEVELOPMENT OF ROCKET TECHNOLOGY AND ASTRONAUTICS IN POLAND BEFORE 1949

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The development of rocket technology in Poland is several /1\* centuries old. It is very likely that the first utilization of rocket weapons in Europe took place on Polish soil, namely during the Tartar attack in the 13th century. The Polish historian Jan Dlugosz, who describes the course of the decisive battle at Legnica (1241) in his chronicles, states in a narrative that the Tartars carried a dragon head high above their troops, the head spewing smoke and fire at the Polish troops, rendering them incapable of continuing the battle. In a monastery near the battlefield of Legnica, there is a painting which accurately depicts the dragon heads employed by the Tartars as described by Dlugosz. Walenty Sebisch (1577-1657), an urban military architect living in Wroclaw in the 16th and 17th centuries, who has left behind many drawings and notes pertaining to rocket use, wrote that the rocket launcher in the form of a dragon head, as employed by the Tartars at Legnica, was a traditional device for hurling military and decorative rockets, later on in the Renaissance as well.

Sebisch's rocket drawings show them equipped with small stabilizers attached to the body of the rocket. Sebisch also drew deep, conical recesses in the fuel which played the role of nozzles. Moreover, rocket clusters can be seen in Sebisch's drawings, corresponding to the current concept of rocket batteries.

Other writers on rockets in Poland were Marcin Bielski in 1569, an anonymous writer in 1623, and del Aqua, a Venetian in Polish service in 1637. In 1643 appeared a Polish translation

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\*Numbers in the margin indicate pagination in the foreign text.

of a book written on rocket construction by a Spaniard, Diego Uffano.

The principal contribution to the development of the art of rocket construction at that time in Poland and in the whole of Europe was the work of Casimir Siemienowicz, representative of the leader of the Polish Crown Artillery of King Wladislaus IV. The book was written in Latin in 1650 and carried the title: Artis magnae artilleriae Pars Prima [The art of heavy artillery, Part One], A year later, in 1651, it was published in French, and translated into German in 1676 and into Dutch and English in 1729. For over 100 years, it was an indispensable textbook for training artillery troops in all the countries of Europe. In the third chapter of his work, Siemienowicz gave a systematic and amply illustrated description of various rockets used at this time, as well as his own designs, including details of construction, fuel components, etc. Siemienowicz was the first one to propose a three-stage rocket, consisting of three nested casings, which were ejected in sequence after the fuel had been burned up. The mass ratio of the first, second, and third stages was 6.4:2.4:1. A two-stage rocket, with a rocket cluster (rocket battery) being employed as the first stage, was also described and drawn in Siemienowicz's book. In certain rockets, instead of the stabilization rods, Siemienowicz employed two, three, or four small stabilizer fins.

In the Warsaw Arsenal at the beginning of the 19th century, Josef Bem, a captain in the Royal Artillery, built rockets for the use of troops of the Polish Kingdom. His report on the constructions, machines, and fuels to be employed appeared in 1820 in French and German. In his report, Bem also described a rocket attack by the English fleet against the city of Gdansk in 1813.

In the battle of Grochow (February 25, 1831), rocket launchers were successfully employed by the Polish revolutionary Chief of Staff, General Pradzynski, against an advance of the Russian cavalry. He himself described it some years later in his Memoirs.

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The complex development of science and technology at the end of the previous century also contributed to the development of the theoretical foundations of space flight, and indicated the possibility of using rockets for this purpose.

One of the first to concern himself with this subject in Poland was Mieczyslaw Wolfke, who was later to be a well-known physicist and professor at Warsaw University. As a young man in 1895, he already wrote about using rockets outside the atmosphere of the Earth. Starting in 1913, Franciszek Abdan Ulinski dealt with the topic of rocket flights, and his article on using electrically charged particles to propel the rockets appeared in the Viennese magazine "Der Flug" in 1920. The electrically charged particles were to serve as ejected mass, thus propelling the rocket which Ulinski called a "cathode rocket." The energy source was to be solar radiation -- using thermoelectric batteries. Present-day ion thrusters are in a certain sense the implementation of Ulinski's ideas.

In 1932-1933, a young, as yet unknown researcher born in Sieradz near Lodz in Poland, Ary Szternfeld, wrote his "Introduction to cosmonautics" for which he was later honored by the French Astronomical Society. On December 6, 1933, Szternfeld gave a report in the Astronomical Observatory of Warsaw University on the results of his work. Two years later, Szternfeld moved to the Soviet Union, where he published an abbreviated form of his work "Introduction to cosmonautics" as a book in 1937.

Thanks to his Benedictine, arduous work, Szternfeld was able to calculate in his work the most favorable space-flight trajectories for minimizing fuel consumption, trajectories which are astonishingly relevant even today. It is sufficient to observe that more than 150 artificial earth satellites have been launched by the Soviet Union and the United States -- in the first 8 years of the space-flight era -- on the eleven orbital trajectories calculated by Szternfeld. The main parameters of the circular orbits of the Vostoks with Gagarin, Titov, Nikolayev, Popovich, Bykovski, and Tereshkova, as well as the Mercury Capsules of Glenn, Carpenter, Shirra, Grissom, Young, and Cooper differed by no more than 0.3 to 0.7% from those of the orbits calculated by Szternfeld!

In the 1930's, Dr. Casimir Zarankiewicz, later professor of mathematics and mechanics at the Polytechnic Institute in Warsaw and the first President of the Polish Astronautical Society, dealt with questions of rocket flights in the atmosphere of the Earth and in outer space. However, realization of rocket flights seemed a long way off at that time, and a claim that technological development would shortly result in such flights was usually received skeptically, as I was able to find out for myself during my reports given in the years 1934-1936.

However, discussions on this problem were very popular, and scientific magazines as well as popular weeklies have revealed new information on this topic from time to time. As an example, the weekly magazine "Tecza" already published in December 1928 an exhaustive article on the future and reality of space flights, based on the works of Esnault Pelterie and the experiments of Opel.

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